IMPACT OF THE ARCHITECTURAL DESIGN PROCESS ON STUDENTS PERFORMANCE IN DESIGN STUDIO PROJECTS

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Abstract

Architecture can be seen as a discipline that poses several design challenges from conception to design realization stages. This path by which the idea of an architect is translated from the mind to paper and then birthed to life is known as design process. To solve design problems, architects have to go through a systematic design process, which vary with individuals and groups. In whatever way, this is done, the process determines the output and resulting performances. Hence, this study investigates varying design processes and the impact it has on students' performances in their design studio courses. This study adopted a survey approach with 300 structured questionnaires distributed in three Schools of Architecture in southwest Nigeria. The Results showed two distinct design process approach by students namely: (i) Students who derive design concept in mind and stick to it from the beginning of the project to the end; and (ii). Students who embark on research with guided relevant key parameters to direct their project. Findings show that students in the latter category perform better in the design studio. Furthermore, the study recommended that the design process approach is important, but the rule of thumb is not a major determinant factor to performance in architectural design studio.

Keywords: Architecture, Architecture students, Design process, Design Studio, Student performance.

1 INTRODUCTION

Impact in clear terms refers to having an effect or influence on something caused by new ideas, ideologies, concepts, technologies, etc. For something or someone to experience impact, these terms stated above must have evolved.

The major aim of the study of Architecture is to prepare students for the conditions and problems of practice and to familiarise them with real situations concerning design construction and coordination. In the study of architecture there are some main aspects used in the training. These include; technology and scientific courses, artistic courses and design courses which encompass the other two courses. It is basically an interactive course where students interact among each other and with their supervisors to reach a solution to a design problem. Architecture plays a significant and undeniable role in the physical and socio-economic development of societies. Apart from its prime function of enhancing the aesthetic outlook of the environment and the functional efficiency/structural integrity of city structures, it is used to promote the national identity and pride of the society that produces it [1]; [2]

Over the years, students have arrived at their designs applying several processes. One way or the other, there must have been a step to step approach students of architecture must have adopted to go about tackling challenges faced in transferring their thoughts and ideas to paper. This is what is known as the architectural design process.

The architectural design process can be seen as a concept in architectural education, that student architects try to adapt in order to go about design studio projects in order to have a clear understanding about the project and in turn positively affect their performances. This process has helped architecture students positively in the sense that, however they arrive at their final designs, learning must have taken place because whenever these students are faced with design challenges, they try to adopt methods they have used to tackle previous challenges in order to create solutions. [3] stated that learning is primarily understood as the process of transforming information into knowledge and competencies. In the learning process, humans do not behave as a 'copy machine'. On the contrary, when faced with various sources of information and data, we selectively build knowledge and competencies and determine their relative value.

[4], in a previous study stated that 'Architectural education is distinguished from other disciplines being one anchored on apprenticeship. The apprenticeship of the future professional is shaped and modelled within the confines of the design studio. The design studio is at the heart of most industrial design curricula and is a place where students learn to visualise and represent aspects of a problem graphically and to think as a designer'. The design studio is at the heart of most industrial design curricula and is a place where students learn to visualise and represent aspects of a problem graphically and to think as a designer [5]; [2]

The learning experiences of the students may however go beyond the studio [6], but also has an impact or effect positively or negatively on the performance of architecture students in their design studio projects.

This study focuses on identifying the various ways by which students design and the performance in design studio projects. This study is very important because it provides relevant information to teachers or studio supervisors concerning the aspect of the design process and that there might not be just one way students to designing to achieve results.

2 LITERATURE REVIEW

In the last decade, the effect of architectural design studio process on students' performance has received little attention with only a few direct publications. However, studies concerning closely related topics have been carried out on subjects such as learning styles in relation to student performance.

Design problems in Architecture over time have become much more complex. Some of these problems one is meant to consider include the social needs of people, sustainable energy conservation, population and economic growth and also environmental conditions. Due to the fact that these problems have changed overtime, it would be essential and be of great benefit, to train young talented/non-talented designers, to approach designs using the design processes, in order to help them tackle future challenges and address more complex problems easily [7].

[8] in a study conducted to understand the "Concept of Creativity and Innovation in Architectural Design Process" derived that the Architectural design process is the scientific study of existing ideas, thoughts and thinking in getting detailed solution of an Architectural design. It has been explained that the difference between Architectural design process and scientific methods is that, Architectural design is concerned with how things ought to be done while natural sciences are concerned with how things are.

2.1 Overview of the design process

Different fields have different approaches to the design process, but all these approaches do not stray far away from the main essence of the design process, which is to solve problems using organized steps. Substantial disagreement exists concerning how a designer in many fields, whether amateur or professional, alone or in teams, produce designs. [9] argued that there are many ways of describing design processes and discussed two basic and fundamentally different ways, both of which have several names. The prevailing view has been called The Rational Model, Technical Problem Solving and The Reason-Centric Perspective. The alternative view has been called Reflection-in-Action, Evolutionary Design, "co-evolution and The Action-Centric Perspective. The Rational Model was independently developed by [10]. It posits that designers attempt to optimize a design candidate for known constraints and objectives, the design process is plan-driven, and the design process is understood in terms of a discrete sequence of stages. The Action-Centric Perspective is a label given to a collection of interrelated concepts, which are antithetical to The Rational Model. It posits that designers use creativity and emotion to generate design candidates, the design process is improvised, no universal sequence of stages is apparent – analysis, design and implementation are contemporary and inextricably linked.

It is important to note that the design process is endless, since design problems defy comprehensive description and offer an inexhaustible number of solutions. The design process cannot have a finite and definable end as more problems seem to arise every day on these subject matters. Suffice to say, a designer's job is never really done, as there is always more and better to be done.

Also, as studied by researchers, the design process involves finding problems, as much as it entails solving problems. As is the nature of solving design problems, the designer definitely has to expand on the subject matter which poses more questions, and in turn, a new problem. A new problem is

always generated from an existing one. It is central to modern thinking about design that problems and solutions are always seen as emerging together, rather than one following logically upon the other.

There are different phases from the inception of the design to the completion of the construction. There are various processes and stages to follow during each phase of an architectural design, but in relation to the subject matter being studied, these phases include, identifying a need, writing a design brief, scheduling tasks, analysing the brief given, synthesizing, researching the problem, writing a specification, generating ideas and possible solutions to the problem, selecting a preferred solution and developing, preparing working drawing and plans ahead, construction of a model, testing and evaluating the design and finally writing a report.

2.2 Architectural design process and performance

The architectural design process has a role to play in the performance of students in design studio. Some previous researchers have carried out researches in this field. [11] in a study proposed that students' performances may be affected by the constraints set on a design problem and their learning styles. They explored the performance of interior architectural students in relation to their learning styles (as proposed by Kolb's experimental learning theory), and different types of constraints set on design problems. In their study, Design performance, measured as conceptual development, form and spatial configuration, structural innovation and ergonomics and craftsmanship was found to change throughout the two-bipolar continuum of learning cycle with regard to two design conditions characterized by different types of constraint use.

[12] studied the performance based on design considering current practices and research. The study aimed at exploring the viability of performance based design in practices considering that its field is defined through analysis of current work in it. The research involved exploring a case study from an experimental digital design studio. After it was discovered that in performance based design architectural design both generative and evaluative capabilities can be integrated within performance based simulations

[13] studied cognitive styles and student progression in architectural design education. This paper investigates how students with particular cognitive styles, perform in design project work at particular stages of Architectural Education. It deals with the way students perceive and process information.

The performance of the students is the measure of learning accomplishment. This is often reflected in the grades of the students. A major form of assessment for architecture students is the design jury. This is often because design is a major course taken by the student, which occupies most of the lecture hours of the students [6].

3 METHODOLOGY

The sources of data used in this research were primary and secondary data. The primary data was obtained by the researchers based on the analysis of the data gotten from three (3) selected schools of Architecture, all in South-West, Nigeria. The secondary data was gotten from articles which have already been stated in the theoretical framework of this study. Data gotten were collected between January and March, 2016.

3.1 Research objectives

This study was carried out to identify the processes architecture students use in arriving at their designs and also to assess the students' performance in design studio in three (3) selected schools of Architecture in south west Nigeria. These schools include, Covenant University Ota, Ogun state, University of Lagos, Lagos state and The Bells University, Ota, Ogun state.

3.2 Research method and data analysis

Two methods were adopted in carrying out this study. A survey method, in which 300 questionnaires containing close and open ended questions were distributed to the three selected schools the questionnaires were administered to random selection of students from all levels of study in the schools except 100 level students who have no idea of the design studio course and so therefore are not enrolled to take up the course in their first year. Also, five students were interviewed.

Data collected were analysed using Statistical Package for Social Science (SPSS). The data on respondents' profiles were analysed using descriptive statistics. Analysis of variance was carried out for areas concerning age, year of study etc. Another analysis carried out in this study was the regression analysis used to determine the design methods that have influenced the academic performances of the students in design studio projects.

4 RESULTS AND DISCUSSIONS

Three hundred questionnaires were distributed to the three (3) selected schools and two hundred and fifty questionnaires were filled, returned and analysed. From the findings, most of the respondents (40%) were from the University of Lagos, Lagos state, (36%) from Covenant University Ota, Ogun state and (24%) from The Bells University, Ota, Ogun state. Amongst the respondents, 9.2% were in 200 level, 35.6% were in 300 level, 34.45 were in 400 level, 13.2 were in M.Sc. 1, and 7.2% were in M.Sc. 2. Most of the respondents were within 19-21 years of age as 3.2% of the respondents were less than 16 years, 16.4% of the respondents were within the age range of 16-18 years, 57.6% were within the age range of 19-21 years, and 22.0% of the respondents were above 22 years. Finally, most respondents of this survey were male students as 61.2% of the respondents were male students, and 38.8% of the respondents were female students. It can be deduced that there were more male respondents in the survey than females.

Thirty-one (31) variables were reduced to eight (8) factors by factor analysis (Table 1). These factors account for 49.547% of the variance in the data. The first factor represents the comprehensive people, who prefer to take things step-by-step, and are like to apply the knowledge gained from structures and building components to their design. The second factor represents the people who are instinctive and innate in designing and like to come up with their own interpretation of the design brief, rely on their intuition in their design while being constantly aware of the mistakes they make. The third factor represents the people who are analytical in designing, as they come up with a wide range of alternatives before coming up with a final design, and then explore and interpret the design problem thoroughly before actually designing. The fourth factor represents those who are precedential, as they like to refer to past designs and examples, before they reach their design, and like to evaluate their sketches, before sticking to one. The fifth factor accounts for those who are tenacious and fixative, and do not discard their first ideas, but keep working on them to make it better, follow the same set of procedures in all their designs, and start coming up with design ideas when given the brief, even before any analysis is carried out. The sixth factor represents the methodical or meticulous people, who consider all issues before arriving at a final design, and have a reason for every line drawn in their design. The seventh factor represents those who are perceptible and use their senses to visualize their design in a 3-Dimensional form without actually physically seeing it. The eight factor, which is the last factor represents the people who are sequential and serial, and split their design process into stages and phases.

As can be deduced from Table 2, the activity the respondents spend the most time on is working out the details of the design, with an average of 3.86, followed by organizing their thinking, with an average of 3.656, followed by carrying out research on the design object, with an average of 3.544, followed by analyzing the design from different viewpoints with an average of 3.423, followed by defining the design objectives, with an average of 3.364, followed by considering alternatives for the design, with an average of 3.292. The activity the respondents spend the least time on is acting critical questions to frame the design problem, with an average of 3.264

Table 1: Components that describe the design process adopted by students

Factors	Variables	Component loadings
Factor 1: Comprehensive	I utilize the knowledge of building components and methods (construction) actively in building design	.693
	I take things step-by-step	.614
	I utilize the knowledge of structures actively during design	.562
Factor 2: Instinctive/ Innate/ Subjective	I come up with my own interpretation of every design brief	.711
	I rely on intuition (Instinct) in my design	.649
	I am aware about the mistakes i sometimes make	.628
Factor 3: Analytical	I consider a wide range of alternatives before coming up with a final design	.667
	I thoroughly explore and interpret the design problem before i actually design	.595
Factor 4: Precedential	I often refer to past designs in my designs	.716
	I design by referring to examples	.631
Factor 5: Tenacious/ Fixative	I take more time evaluating the sketches I have before i stick to one	-.624
	I do not discard my first idea. Instead, i keep working on it to make it better	.704
	I follow the same set of procedures in all my design	.632
	Immediately i get a brief, i start coming up with design ideas even before i carry out any analysis	.606
Factor 6: Methodical/ Meticulous	I consider all issues before i arrive at a final design	.760
	I have reasons for every line i draw in my designs	.699
Factor 7: Perceptible	I visualize my design in 3D	.683
Factor 8: Sequential	I usually split the design process into stages/phases	.603

Table 2: Descriptive statistics for the proportion of time spent carrying out the listed activities

Descriptive Statistics		
	N	Mean
Working out the details of the design	250	3.8600
Organizing your thinking	250	3.6560
Carrying out research on the design object	250	3.5440
Analyzing the design from different viewpoints	250	3.4320
Define the design objectives	250	3.3640
Considering alternatives for the design	250	3.2920
Asking critical questions to frame the design problem	250	3.2640

From Table 3, the most influencing factor when making a design decision is producing a functional design, with an average of 4.232, followed by making sure the design works, with an average of 4.184, followed by materials and the construction process, with an average of 4.168, followed by the structural systems of the design with an average of 4.128, followed by climate and natural forces, with an average of 4.1, followed by the benefit the design provides to the users, with an average of 4.072, followed by the building regulations, with an average of 4.0, followed by the constraints in the design brief, with an average of 3.98, followed by social and cultural influences, with an average of 3.88, followed by ease of implementation of the design, with an average of 3.828. The complexity of a design came in as one of the factors that least influenced the respondents when making a design decision with an average of 3.804, followed by production of a novel and genuine design, with an

average of 3.764, followed by the cost of a design, with an average of 3.56. The least influential factor was seen to be trade-offs between alternative designs, with an average of 3.46.

Table 3: Factors that influence respondents when making a design decision

	N	Mean
Producing a functional design	250	4.2320
Making sure the design works	250	4.1840
Materials and construction	250	4.1680
Structural systems	250	4.1280
Climate and natural forces	250	4.1000
Benefit of a design	250	4.0720
Building regulations	250	4.0000
Design brief constraints	250	3.9800
Social and cultural influences	250	3.8800
Ease of implementation of a design	250	3.8280
Complexity of a design	250	3.8040
Producing a novel (genuine) design	250	3.7640
Cost of a design	250	3.5600
Trade-offs between design alternatives	250	3.4600

In assessing the performance of students in design studio projects, their last studio grades was used, but that might not be enough to determine how these students perform overtime as they progress in their various schools of Architecture. A frequency distribution table was generated to analyse results found. 26.8% of the respondents had A in the previous design studio, 48% of the respondents had B, 24% of the respondents had C 1.2% of the respondents had D, and 0% had E and F in the previous design studio.

Table 4: Frequency distribution showing last studio grade percentage of the respondents

	Frequency	Valid Percent
A	67	26.8
B	120	48.0
C	60	24.0
D	3	1.2
Total	250	100.0

In order to determine the impact or effect the design processes listed above have on the performance of students in these three schools of Architecture, a regression analysis was carried out. The result was significant (F=2.838, P=0.000). The variables that were significant accounted for 27.2% of the variance (R^2= 0.272). The first variable is the cost of design, and this means that those who consider the cost of the design in their design tend to perform better. The second variable is the tenacious and fixation, and the analysis shows that students who get fixated do not really perform well in design studio. The next variable is the sequential process, and the analysis from the data gathered show that students who are sequential or methodological do not tend to perform well in design studio. The table further shows that those who organize their thinking do not tend to perform well in design studio, while those who work out the details of their design tend to perform better in design studio.

Table 5: Table showing how the design process factors affect student performance by regression analysis

	Unstandardized Coefficients	Standardized Coefficients		t	Sig.
	B	Std. Error	Beta		
(Constant)	1.522	.591		2.577	.011
Cost of a design	.169	.048	.248	3.529	.001
Tenacious/ Fixative	-.161	.046	-.216	-3.489	.001
Sequential	-.147	.045	-.197	-3.240	.001
Methodical/Meticulous	-.147	.048	-.197	-3.065	.002
Organising your thinking	-.154	.062	-.182	-2.498	.013
Working out the details of the design	.116	.056	.138	2.063	.040
Complexity of a design	.033	.017	.120	1.912	.057
Trade-offs between design alternatives	.102	.055	.140	1.876	.062
Comprehensive	-.087	.052	-.116	-1.666	.097
Benefit of a design	-.117	.073	-.128	-1.604	.110
Structural systems	.126	.086	.111	1.467	.144
Carrying out research on the design object	.096	.071	.105	1.353	.177
Materials and construction	-.106	.079	-.103	-1.338	.182
Design brief constraints	-.080	.067	-.083	-1.197	.233
Precedential	-.051	.046	-.068	-1.121	.263
Producing a novel (genuine) design	.060	.055	.073	1.096	.274
Perceptible	.049	.048	.066	1.037	.301
Analytical	.054	.054	.072	.998	.319
Considering alternatives for the design	-.058	.061	-.072	-.962	.337
Define the design objectives	.064	.067	.071	.954	.341
Ease of implementation of a design	-.020	.022	-.056	-.905	.366
Climate and natural forces	-.019	.023	-.052	-.821	.413
Analysing the design from different viewpoints	-.052	.071	-.060	-.737	.462
Social and cultural influences	.038	.066	.041	.573	.567
Instinctive/ Innate/ Subjective	.026	.050	.035	.519	.604
Producing a functional design	-.022	.062	-.026	-.356	.722
Making sure the design works	-.020	.069	-.023	-.294	.769
Asking critical questions to frame the design problem	-.005	.060	-.005	-.076	.939
Building regulations	.002	.073	.002	.029	.977

Table 6: Table showing summary of regression analysis carried out to determine the effect of design process on performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.522[a]	.272	.176	.67809	.272	2.838	29	220	.000

5 CONCLUSIONS AND RECOMMENDATIONS

This study focused on finding the relationship between the design process and the performance of students in architectural design studio. So as to ascertain the different design processes, their different

aspects and the aspects that are material to the grading scheme along with the gravity of such aspects. Various factors were explored and considered in the study of this topic; the student profile, the processes the results. To give a proper and recognisable result in terms of findings.

In most schools of architecture in Nigeria, there is little attention paid to the students' individual design process as a general one is often introduced and assumed general, this leads to the diversity in performance as a result of the student's conscious or unconscious concentration on certain steps or reconstruction of these steps in their design process.

There is therefore a need for institutions to recognise the presence of this diversity and address it in the design studio as a course either through the grading system or by making some befitting changes to the mentorship system and also for students to be educated and be investigated so as to know where they stand regarding this thesis in order for it to be addresses by either or both the schools and institutions so as to bring better results and to develop students individually as architects.

It is therefore recommended that:

- Architecture students should be assessed and categorized intermittently to establish their standings in terms of this study.
- The situation of diversity in the design process and its outcomes should be addressed more by schools of architecture
- Tutorship for students to improve or develop aspects of their processes should be carried out by schools.
- Diversity in the brief of design studio to address all the categories of students and the different outcomes of the processes should be encouraged
- There should be improvement on the grading scheme for architecture design studio to accommodate processes and aspects of design that have been overlooked but are important.

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